Interface Reconstruction on General Polygonal Meshes

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Numerical simulation of multimaterial, multiphase flows in an Eulerian framework often requires special procedures to explicitly track interfaces between multiple materials and phases [1, 2].

We are developing new and efficient means for reconstructing piecewise linear interface representations in complex flow simulations when the volume fractions of the different materials are specified in the elements of the mesh. Our methods are designed to work on general polygonal meshes in 2D and polyhedral meshes in 3D. Moreover, the reconstruction algorithms we are developing are applicable to flow simulations where more than two materials may come together to form a material junction. While previous efforts with multimaterial interface reconstruction require processing of the materials in a user-specified order to get the correct interface topology, we are developing methods which will eventually allow automatic determination of material ordering. Our algorithms are also designed to produce interfaces that are continuous, as far as possible, across element boundaries.

Initial results from the developed procedures indicate that the procedure is fast and reproduces interfaces accurately.

[1] S.J. Mosso, B.K. Swartz, D.B. Kothe, and R.C. Ferrell, "A Parallel, Volume-Tracking Algorithm for Unstructured Meshes," in P. Schiano, A. Ecer, J. Periaux, and N. Satofuka, Eds., *Parallel Computational Fluid Dynamics: Algorithms and Results Using Advanced Computers* (Elsevier Science B.V., 1997) pp. 368–375.

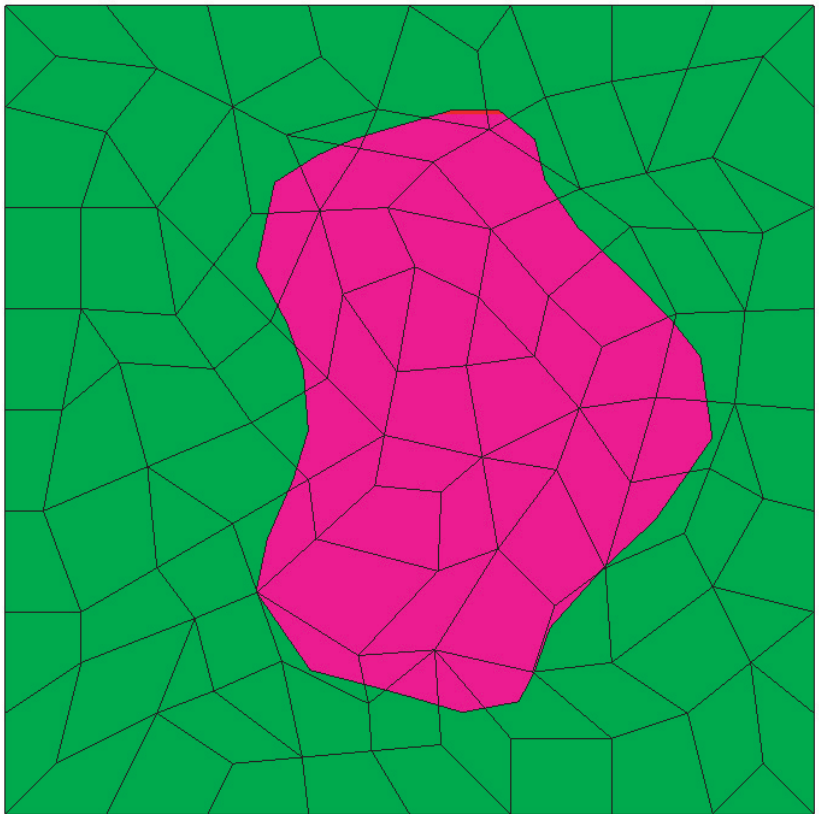

Figure 1—
Interface reconstruction of a general shape on an unstructered mesh.

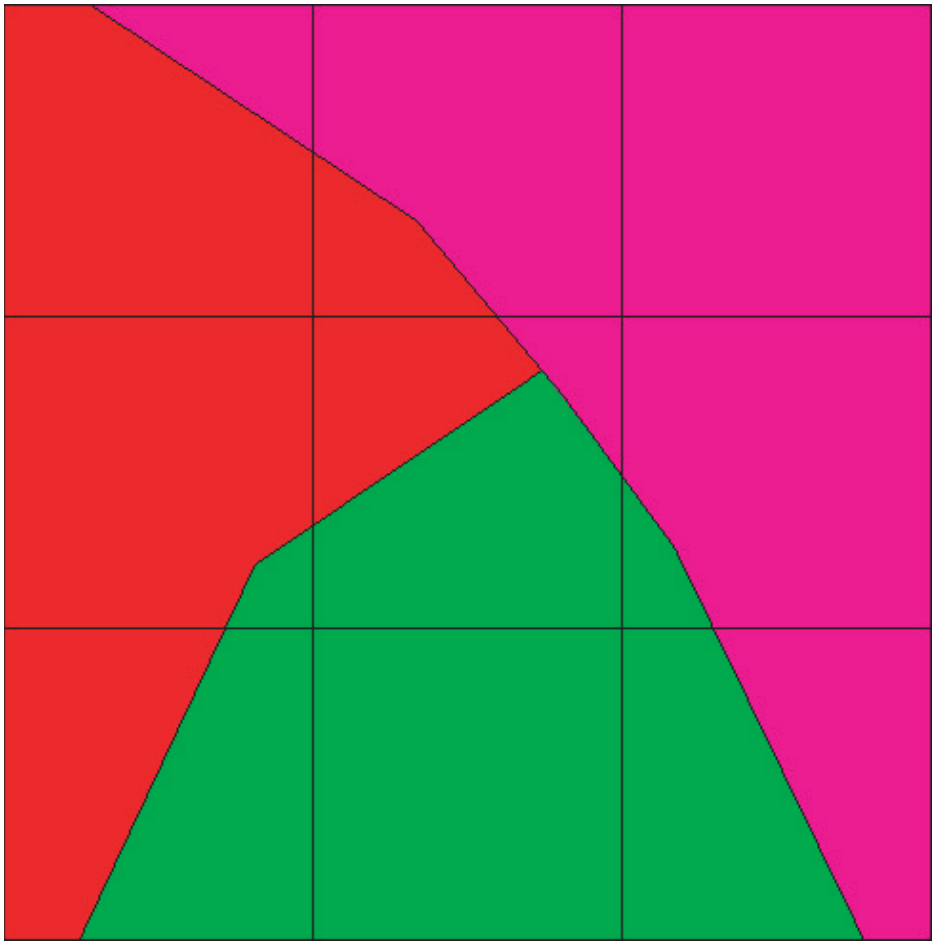

Figure 2— Multisegmented reconstruction of a three-material interface.

[2] R.D. Giddings, "HELMIT—A New Interface Reconstruction Algorithm," in E.F. Toro, Ed., *Godunov Methods: Theory and Applications* (Kluwer Academic/Plenum Publishers, 2001) pp. 367–376.

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Acknowledgements
We would like to acknowledge NNSA's Advanced Simulation and Computing (ASC), Advanced Applications Program, for financial support.